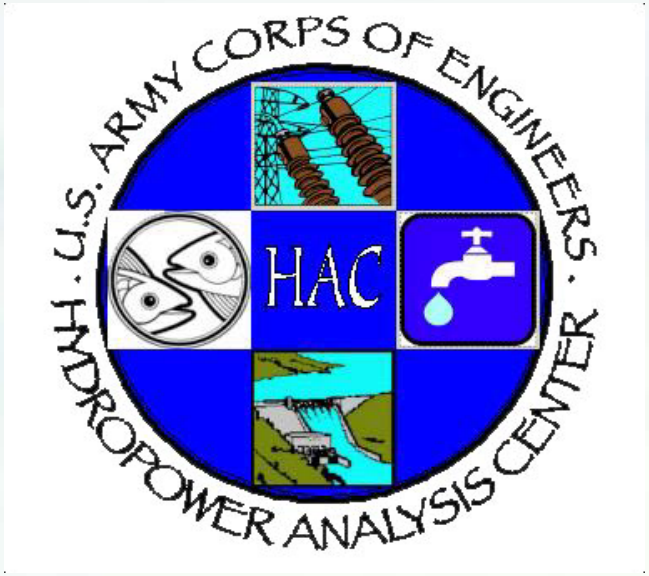


Corps of Engineers Center of Expertise

for

Hydropower Analysis & Economic Evaluation

US Army Corps of Engineers

Water Management Division

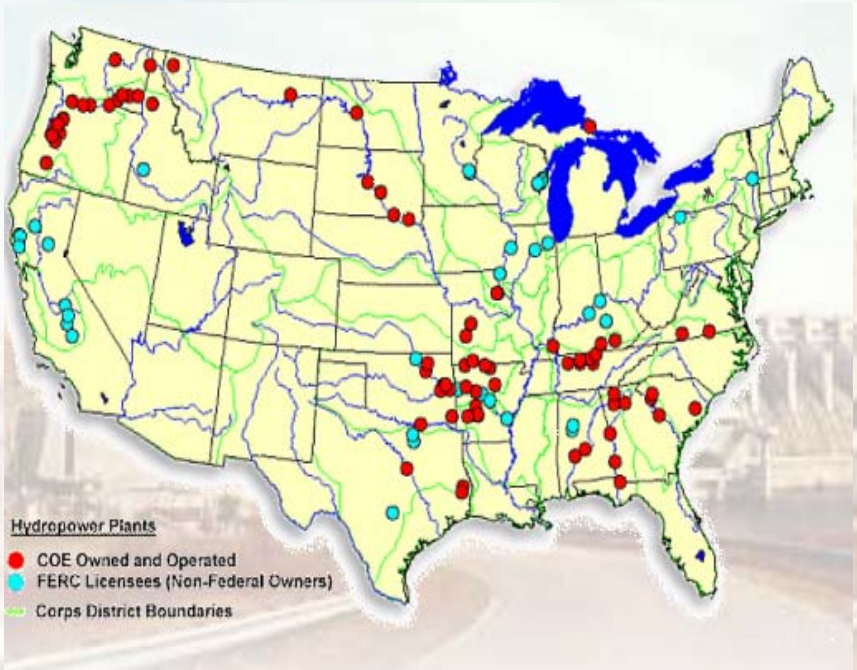
Power Branch

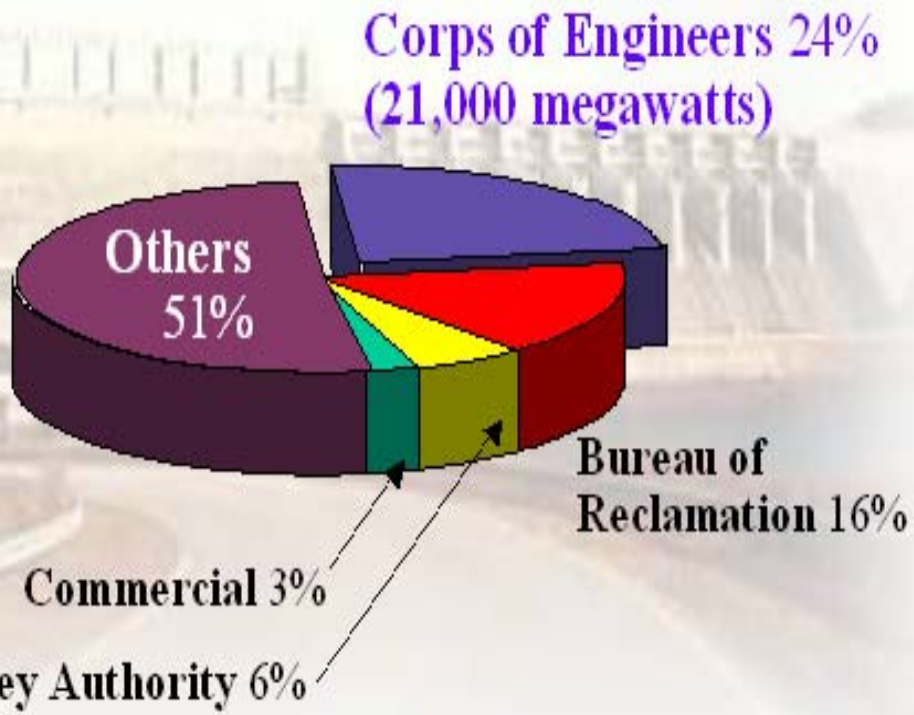
Portland, Oregon

The Corps and Hydropower

Hydro represents 13% of US Electrical Power.

The Corps has an $18 billion investment in hydropower facilities (75 plants; 350 generating units)





US Army Corps
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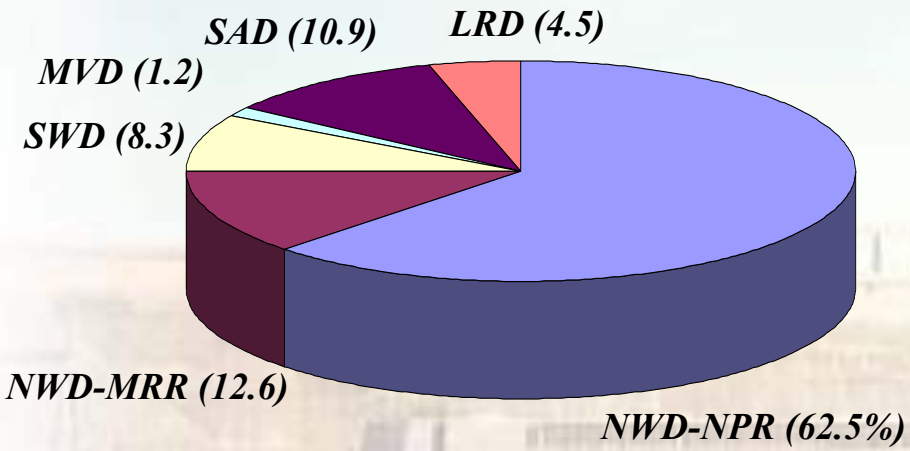
Corps Hydropower Capacity by Division



Largest NWD Hydropower Dams (by MW Install. Cap.)

Chief Joseph (NWS) 2,460 MW

John Day (NWP) 2,160 MW

The Dalles (NWP) 1,800 MW

Bonneville (NWP) 1,093 MW

McNary (NWW) 980 MW

LWG, LGS, LMN (NWW) 810 MW (each)

Oahe (NWO) 786 MW

IHR (NWW) 603 MW

Libby (NWS) 525 MW

Garrison (NWO) 518 MW

Dworshak (NWW) 400

Bonneville Dam Second Powerhouse

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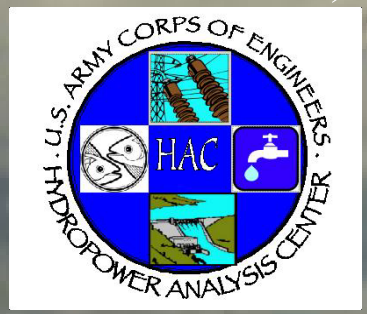
U.S. ARMY CORPS OF ENGINEERS · HYDROPOWER ANALYSIS CENTER · HAC

Two Hydropower Centers of Expertise:

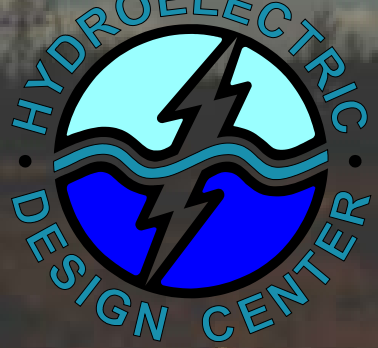
- Hydropower Analysis Center (HAC):

hydropower and water resource planning and analysis (originally established in 1949 to determine feasibility of proposed hydropower projects in the Pacific NW).



- Hydroelectric Design Center (HDC):

engineering and design (originally established in 1948 to support new hydroelectric development on the Columbia River system)



HAC Roles & Capabilities

The HAC has over 50 years of experience in :

- **Powerplant sizing, upgrades, and rehabilitation**
- **River system analysis**
- **Cost allocation and reallocation**
- **Power value and benefit computations**
- **Environmental and other powerplant studies**

- **Staff is cross-trained & familiar with stakeholders in all regions**
- **Works closely with 16 districts, PMA's, HQUSACE**
- **Helps the COE meet its hydropower functions efficiently**
- **Maintains in-house hydropower expertise to ensure that Corps can continue to efficiently carry out its hydropower mission**
- **Support US assistance to other countries (e.g., China, South Korea, Nigeria, Mozambique, etc.).**

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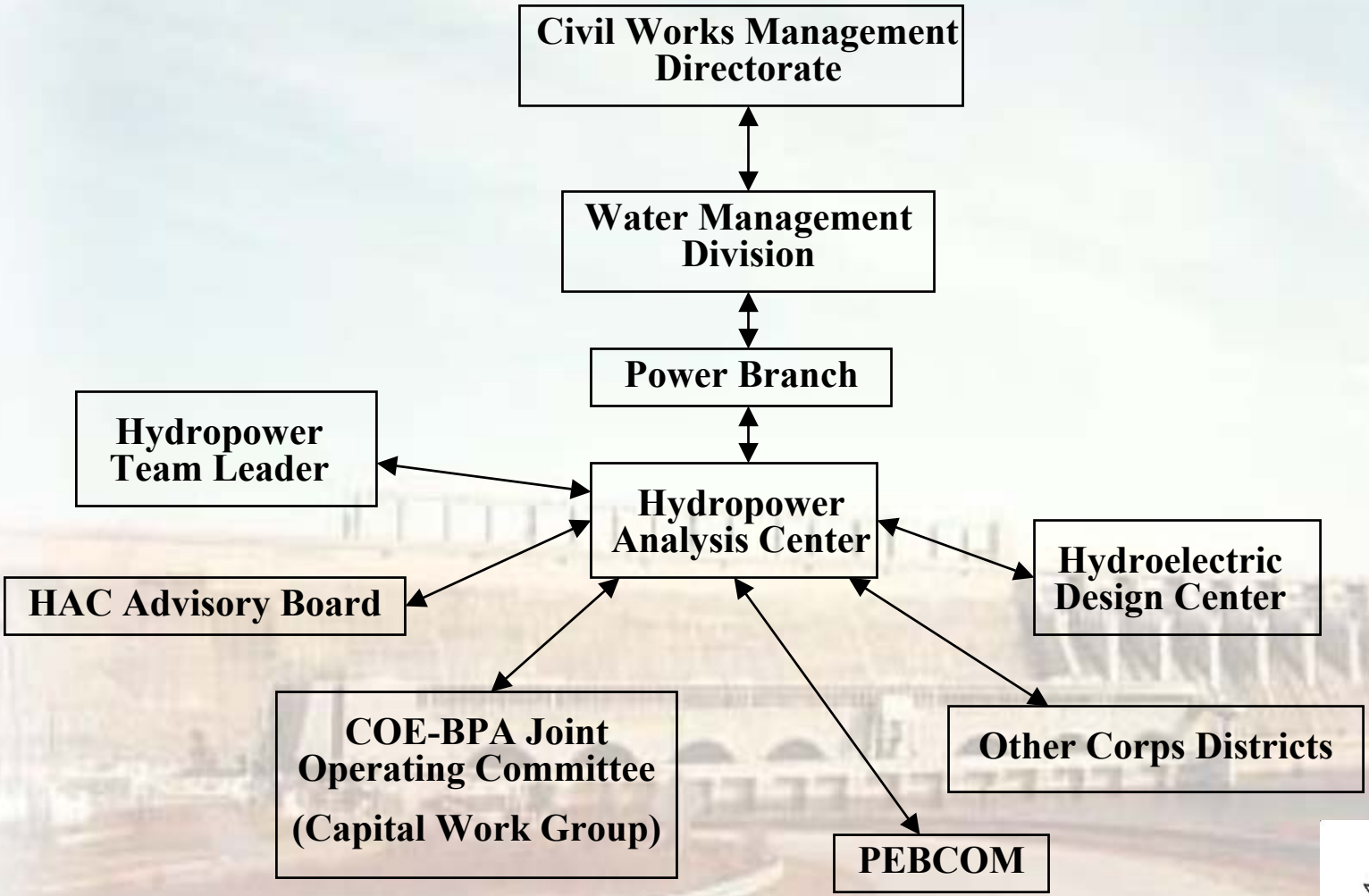
Organization and Affiliations



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Problems & Opportunities

- **Average age of powerplants: 35 years**
- **350 turbines installed & over 80% are in need of replacement/rehab due to**
  - ✓ Normal wear and tear
  - ✓ New operating criteria for turbines operation
- **Need to develop rehabilitation/upgrade plan for ALL Corps generation facilities**
  - ✓Investments to be systematically analyzed and prioritized on a system basis –rather than piece-meal.
  - ✓Recognize regional differences
  - ✓Adapt to new funding climate
  - ✓Use uniform and consistent evaluation criteria

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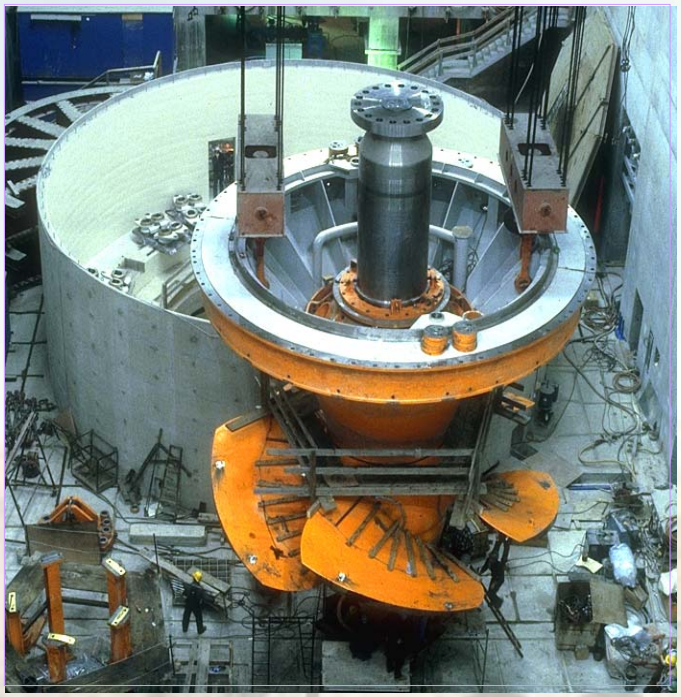
Powerplant Major Rehabilitation Analysis



- *Hydrologic/Hydraulic Engineering & Modeling*
- *Unit Sizing & Optimization*
- *Generation Assessments*
- *Power System Modeling*
- *Economic Analysis*

- **Over 18 major projects evaluated thus far (over $600 million of work completed, involving:**
- **Turbine replacement/refurbishing**
- **Generator Rewind and Governor Upgrade**
- **Transformer/Switchyard Replacement**

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Examples of Rehabilitation Projects

Under Construction:

- **Bonneville** ***(Portland District)***
- **J. Strom Thurmond** ***(Savannah District)***
- **Dardanelle** ***(Little Rock District)***
- **John H. Kerr** ***(Wilmington District)***
- **Garrison** ***(Omaha District)***
- **Jim Woodruff** ***(Mobile District)***

Under Design:

- **Whitney** ***(Ft. Worth District)***
- **McNary** ***(Walla Walla District)***

Under Planning:

- ***Garrison, Omaha***
- ***Denison, Tulsa***
- ***Chief Joseph, Seattle***
- ***Old Hickory, Nashville***
- ***Fort Randall, Omaha***
- ***Cougar, Portland***
- ***Center Hill, Nashville***
- ***Barkley, Nashville***

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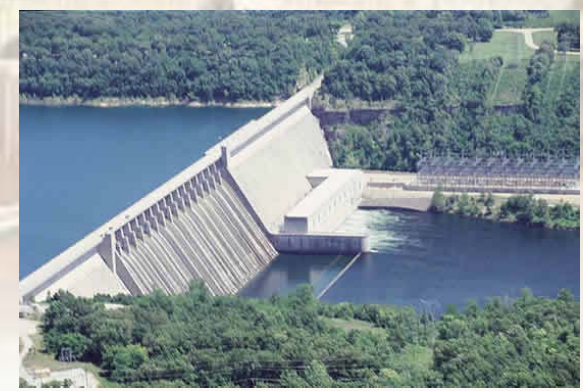
Water Supply Analysis

- ***Hydrologic Analysis & Modeling***
- ***Re-allocation Effects on Generation***
- ***Economic Effects***

Example: White River Min Flow Water Supply Reallocation Study

The White River Minimum Flow study started in 2001for the Little Rock District. This study is evaluating the impacts of reallocating power storage to provide a minimum flow for fish in the White River. All five White River basin projects are impacted.

Bull Shoals Dam



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River System Analysis

- ***River System Optimization***
- ***Environmental & Water Quality Studies***
- ***FERC Relicensing***
- ***Hydropower Effects***

Examples:

- Columbia River System Operation Review in the Northwestern Division
- Alabama-Coosa-Tallapoosa, Apalachicola-Chattahoochee-Flint River Basin Study for the Mobile District
- Savannah River Basin Study for the Savannah District

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